

Remarks:

Claims 12, 15 and 20-21 have been canceled. Claims 10, 11, 13-14, 16-19 have been amended. New claims 22-25 have been submitted. The subject matter of the newly added claims can be found page 7 of the description, in the paragraph preceding the first example.

Specification

Applicants have proposed a revised abstract and the insertion of section heading to comply with 37 CFR 1.77 (b).

The bracketed term "Blaine Fineness" has been removed from claim 15.

Rejection based on 35 USC § 112

The paragraph on top of page 3 has been revised to include the wording of independent claims 10 and 15 making clear that the foaming occurs before the injection downhole. It is further noted that example 5 makes clear that the foaming occurs before the injection (see in particular the last paragraph of the specification discussing foam penetration).

The term "a few microns" has been removed from claim 15, so that the micro-cement is now only defined with the maximum particle size and the specific surface area.

Rejection based on 35 USC § 102

Claim 10 has been revised to now include all the features of now-canceled claim 12. Likewise, claim 15 has been revised to now include all the features of canceled claim 15.

Claim 10 as revised specifies that the solid fraction of the cement slurry consists of a specific volume

ratio of ordinary cement (a term defined lines 21-26 of page 3), coarse particles ranging from 200 μ to 600 μ and fine particles ranging from 0.5 μ and 5 μ m. Claim 10 further specifies that the water content in the slurry is less than 50% by volume.

U.S. 6,060,535 (Villar et al.) discloses a cement slurry based on aluminous cement not on ordinary Portland cement or on microcement. Therefore Villar et al. does not anticipate claim 10 nor claim 15.

The cement compositions of Villar have a low water content and a light-weight component. In most cases, the lightweight component is made of hollow spheres. In some specific cases – as disclosed column 3, line 43-45, the lightweight component is made of gas bubbles.

In other words, Villar et al. describes a cement composition that is either

* unfoamed with a slurry including

- light-weight coarse
- ordinary aluminate cement
- fine particles

or * foamed with a slurry including

- gas bubbles
- ordinary aluminate cement
- fine particles

In no-case Villar discloses a composition that would include

- ordinary aluminate cement
- fine particles
- coarse particles and
- gas bubbles

And of course, Villar is totally silent as to the use of micro-cement.

Griffith (U.S. Patent No. 5,484,019) discloses foamed cement compositions including ordinary cement, fine particles but with no particle in the range 200 μ -300 μ . So, Griffith does not anticipate claim 10. Griffith totally fails to describe particles having a size in the range 3-60 nanometers, hence does not anticipate claim 15.

Moreover, Griffith does not disclose compositions having low water content. According to the illustrative example (column 5, lines 20-37), the formulation includes

- 1620 sacks of class A cement;
- 27450 pounds of cementitious fine particles and
- 6.8 gallons per sack of cement.

Based on the paragraph bridging column 3 and column 4, it is clear that the cementitious particles are also based on Portland cement. Therefore, their density is that of ordinary cement.

A sack of class A cement weights 94 pounds and the absolute volume is of 0.0382 gal/pounds (see Table C-2, in Annex C – Cementing calculations of Well Cementing, Erik B. Nelson, attached for the examiner's convenience). Therefore, the weight of the solid blend is equal to $(1620 \times 94 + 27450) = 179730$ pounds, corresponding to a volume of 6865.7 gallons. And the volume of water is $(6.8 \times 1620) = 11016$ gallons. The slurry further includes $(380 + 96)$ gallons of liquid additive, leading to a total volume of about $(6866 + 11016 + 380 + 96) = 18358$ and a water content of $11016/18358 = 60\%$.

U.S. Patent 5,696,059 to Onan describes foamed cement composition having a solid fraction made of a blend of coarse cement and fine cement and optionally silica flour. First note that Onan fails to disclose any additive in the 3-60 nanometers range, and therefore, Onan does not anticipate claim 15.

Table 1 (column 7 and 8) reports tested blends made of ordinary-sized Class H cement and silica flour (which according to column 6 has a particle size no greater than 50 μ). Therefore blend A in table 1 fails to include fine and coarse particles and blends B, D and E fails to include coarse particles. The size of the hematite particles is not mentioned in the Onan reference and is therefore likely to be chosen of about the same size as that of the cement fraction. Nevertheless, let us assume for the purpose of this

calculation that it fails with the 200-600 μ m range. Based on Table C-3 and C-1 on the Well Cementing reference already cited, we can compute the following data:

Blend	Fine	Medium	Coarse
C	18w% fine cement	100wt% class H (+35 wt% silica flour)	66 wt% hematite
Specific gravity	3.14	3.14 +(2.65)	4.95
Absolute volume	0.0382	0.0382 (0.0454)	0.0244

The specific gravity of the solid fraction is thus equal to:

$$[(100+18)*3.14 + 35*2.65 + 66 *4.95]/(100+18+35+66) = 789.97/219 = 3.61$$

With fresh water (specific gravity equals to 1), the slurry density of 19ppg – or 2.777g/cc, is achieved with a water weight fraction of

$$\text{Water(wt\%)} = (3.61-2.77)/(3.61-1) = 0.84/2.61 = 32\%$$

The volume of solid in the blend is thus equal to: $(100-32)/3.61 = 18.83$ and the volume of water is 32, hence a water/volume of $32/(18.8+32)$ or about 64%.

It results from the above that in no case can the compositions mentioned in Onan may fall within the scope of either claim 10 or claim 15 of the present invention.

The compositions of the present invention further have the advantage of allowing superior mechanical performance and better mechanical properties, with lower permeability and better ability to adhere to the casing and to geological formations. Consequently, they are not only novel but non-obvious.

In view of the above, Applicant respectfully requests that a timely Notice of Allowance be issued in this case. The Commissioner is hereby authorized to deduct any fees due with this filing from Deposit Account No. 50-2183 (Ref. 55.0204).

Respectfully submitted,



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